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EUBRANCHIPUS BUNDYI FORBES (ANOSTRACA; CRUSTACEA), A NEW RECORD FROM CALIFORNIA

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Abstract.—A new distributional record for *Eubranchipus bundyi* Forbes, (Anostraca), from California is reported along with a review of the previously known distribution. The two other *Eubranchipus* species found in California are discussed.

Key Words.—Crustacea, fairy shrimp, Anostraca, *Eubranchipus*, disjunct, *Eubranchipus bundyi*

Belk & Brtek (1995) report nine species of the anostracan genus *Eubranchipus* from North America. Eng et al. (1990) reported the first records of *Eubranchipus* in California when they detailed the occurrence in the state of two species. This report adds a third species of this genus, *Eubranchipus bundyi* Forbes to the list of fairy shrimps known to occur in California.

In May 1990, I was sampling vernal pools in Siskiyou County in northern California and on 8 May 1990, collected *Eubranchipus bundyi* from Grass Lake, (T.44N, R.3W, S.22 and 23), on the north side of Highway 97, approximately 35 km northeast of the community of Weed. Grass Lake lies in the extreme end of an eastern arm of the Shasta Valley.

Grass Lake covers approximately 3 square km, is nearly 3 km long and 1.5 km wide. In places, the pool is 0.5 m deep. The pool is at an altitude of 1370 m and is surrounded by coniferous forest. The pool contained sedges and perennial grasses at the time I collected *E. bundyi.*

Grass Lake is formed in Esro Silt loam. This soil has very poor drainage. Water levels in this pool are seasonally astatic, and fed by snow-melt runoff. The pool is surrounded by soils containing high amounts of granite and lava rock.

Water quality data gathered by the California Department of Water Resources for the central part of Siskiyou County in the 1950s (unpublished) showed the surface water in Shasta Valley annual lakes with pH values greater than 9.0 and electrical conductivity reaching a maximum extreme of 12,420 umhos/cm. Sodium and chloride ion concentrations were greater than 2700 mg/L, and these small basins had greatly elevated aluminum and boron levels. Additionally, due to concentration through evaporation, basins such as Grass Lake have a high mineral salt content. Grass Lake is also noted for having a tiger salamander (*Ambystoma tigrinum*) Green population.

Eubranchipus bundyi occurred in areas of the pool that were sparsely vegetated, and 30+ cm deep. They swam actively, but always several cm below the surface. Clasping pairs were observed. No temperature data were taken. Mature adults were taken with an aquarium dip net and fixed in 100% ethyl alcohol before being transferred to a 70% ethanol solution.

The specimens were identified using Belk (1975) and Pennak (1978), and were

verified by Dr. Belk. Specimens are deposited at the California Academy of Science (CASIZ #103358).

Eubranchipus bundyi is known from New Hampshire, Vermont, Illinois, Minnesota, South Dakota, and Nebraska in the central and eastern United States, with unspecified reports from New York, Ohio, Indiana, Michigan, and Wisconsin. In Canada, collections have been made in Quebec, Ontario, Manitoba, Alberta, and Yukon, with unspecified reports from Saskatchewan. In the western United States, collections were made from Arizona, Utah, Wyoming, Washington, and Alaska (Belk, personal communication, Belk 1975, Donald 1983, Hartland-Rowe 1967, Daborn 1976, Forbes 1876, Maynard and Ross 1975). Further investigation may reveal populations in Oregon.

Eubranchipus bundyi is generally found in snow-melt-filled pools in coniferous areas and appears to be more abundant in years when higher-than-average rain occurs during the preceding year (Donald 1983).

Daborn (1976) and Broch (1965) report that upon hatching, the first free-swimming stage of *E. bundyi* has the rudiments of the first nine or 10 swimming legs. Daborn believes the first instar stages pass in the cyst. After eclosion, the metanauplius undergoes a period of rapid development, completing the juvenile stages in 12 days.

Belk (1977) reports temperature tolerances for *E. bundyi*; after acclimating adults at 13.5° C for 19–27 hours, he found an LD50 for males at 29° C and an LD50 for females at 32° C.

Eubranchipus bundyi is reported to co-occur on occasion with *Eubranchipus intricatus* Hartland-Rowe, *E. ornatus* Holmes, *Branchinecta lindahli* Packard, *B. mackini* Dexter, and *B. paludosa* Muller (Donald 1983, Hartland-Rowe 1967, Maynard & Ross 1975).

Eubranchipus bundyi can be seperated from the other two recorded Californian *Eubranchipus* by the apex of the distal segment of the second antennae of the males, which in *E. bundyi* is trifid (whereas in *E. serratus* and *E. oregonus* it is bifid or truncate). *Eubranchipus bundyi* can be distinguished from all other North American *Eubranchipus* by the labrum, which has a large anteriorly produced boss or knob between the bases of the second antennae (Belk 1975, Hartland-Rowe 1967, Forbes 1876).

Eng et al. (1990) first reported the occurrence of *Eubranchipus* species (*E. oregonus* Creaser and *E. serratus* Forbes) from the northern extremes of California.

Eubranchipus oregonus was recorded from a single locality along Deetz Road, 1.7 km, west of Interstate 5, nearly 8 km south of the community of Weed in Siskiyou County. This is approximately 44 km southwest of the *E. bundyi* locality at Grass Lake. The Deetz Road locale is at an altitude of 1770 m in the Cascade Mountain Range. Like Grass Lake, this pool is surrounded by coniferous forest, but the soils are clays in a wet meadow. The vernal pool is seasonally and annually astatic. Other populations occur in western Oregon through Washington to British Columbia, with disjunct populations in Oklahoma (Belk 1975, Eng et al. 1990, Creaser 1930).

Eubranchipus serratus is also known from a single California locality, at McCoy Flat, in Lassen County (Eng et al. 1990). This site is nearly 20 km from Susanville, and nearly 6 km from Eagle Lake. McCoy flat is situated on the south side of Highway 44 between Lassen Park and Susanville at an elevation of 1650 m, in

the southeastern end of the Cascade Mountain Range. This pool is also fed by snow melt and is ringed with conifers.

I attempted to collect *E. serratus* from this site in July 1990 (the previous *E. serratus* collections from this site were made in December), and I found only *Streptocephalus sealii* Ryder.

Belk (1977) measured temperature LD50s for Arizona *E. serratus* of 30° C for males and 32° C for females, and had eggs hatched at 5° C.

Outside California, *E. serratus* is known from British Columbia, Washington, Oregon, Arizona, Illinois, Indiana, Kansas, Nebraska, Wyoming, Maryland, and Virginia (Belk 1975 and 1977, Eng et al. 1990).

Eubranchipus bundyi is the twenty-third anostracan species recorded from California. This is one of ten species discovered in California in the last four years (Eng et al. 1990, Fugate 1993, Thiery & Fugate 1994; one species has yet to be described). The northern extremes are the least explored areas of California for anostracans, and other locales, if not species, will certainly be found.

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